

TEACHING YOUNG CHILDREN TO USE CONTACT LENSES

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Young children with surgically removed lenses and extreme nearsightedness can benefit from contact lenses, but their parents may need instruction to teach their children to accept lenses. In this study, 4 children under the age of 5 years were taught contact lens wear using a shaping procedure. Compliance was rewarded with praise and tangibles, and noncompliance was followed with brief time-out for 3 of the children and restraint for the 4th. Three children showed high compliance during an initial shaping procedure, with a decrease in compliance during initial insertion of the lenses. At 3- to 10-month follow-up, levels of compliance were high. Insertion and removal of lenses were accomplished in substantially less time, with little crying and no need for time-out. All 3 children continue to use the lenses daily, and 2 have shown improved visual acuity. The 4th child, who has Down syndrome, showed low levels of compliance with need for physical restraint throughout. Although his parents reported high compliance when he first went home, fitting difficulties and an infection resulted in plummeting of compliance, and contact lens use was discontinued. This procedure has been used successfully at the same hospital with 11 of 13 other children between the ages of 14 months and 7 years 4 months. Implications for selection of suitable candidates for this intervention and ways to decrease costs are discussed.

DESCRIPTORS: contact lenses, shaping, children

Visual impairment in infants and young children can have serious developmental implications, including limitations in motor and cognitive development (Lewis, 1987). For children with surgically removed lenses (aphakia) and extreme nearsightedness, thick glasses can result in image distortion, altered peripheral vision, compromised visual acuity, and even eventual loss of vision if only one eye is aphakic (Michaels, 1980). Aphakia occurs in approximately 30 children per year in the three provinces of Nova Scotia, New Brunswick, and Prince Edward Island, which have a total population of 1.7 million. Children with aphakia and extreme nearsightedness have benefited from the

early introduction of contact lenses (Levin, Edmonds, Nelson, Calhoun, & Harley, 1988).

In infants and very young children, lenses are inserted by simply restraining the child during the procedure. This is less appropriate for toddlers and preschoolers, who are less easily restrained and may exhibit noncompliance in other aspects of their lives. Physical resistance to lens insertion can result in injury to the eye or discontinuation of lens use. For this reason, it is important to teach children to comply with lens insertion and removal.

Shaping, the differential reinforcement of successive approximations to an end goal (Catania, 1984), has been used successfully to teach a variety of skills, including conversation skills (Bourgeois, 1990), glasses use (Wolf, Risley, & Mees, 1964), inhalation therapy responses (Renne & Creer, 1976), and compliance with radiation therapy (Mathews & Grantmyre, 1985). The purpose of this study was to document and evaluate systematically the effectiveness of a shaping procedure to teach contact lens use in young children.

We greatly appreciate the cooperation of the children and parents who participated in this study and would especially like to thank Paul McDonnell, David Keating, Karla McGrath, and the staff of the care-by-parent unit for their assistance in numerous aspects of the study.

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METHOD

Subjects and Setting

Four children, aged 5 years 1 month (Pierre), 1 year 11.5 months (Charles), 3 years 11.6 months (Adam), and 4 years (Joel), were enrolled in the study over an 18-month period as referrals were made. Three were being fitted with lenses for the first time and showed some noncompliance during eye exams. Charles had been using lenses since 6 weeks of age, but was noncompliant to their insertion. Joel had Down syndrome. All were admitted to a care-by-parent unit in the hospital and seen intensively for contact lens instruction over a 4- to 5-day period, beginning on a Monday or Tuesday. All 4 were seen by the same behavioral psychologist.

Measures

Daily lens use and visual acuity were the ultimate dependent variables in this study. However, immediate measures of compliance and noncompliance in response to adult commands were recorded during training sessions and follow-up observations. Compliance was defined as the initiation of a response within 5 s of an adult command. Noncompliance was defined as no initiation of a response within 5 s, as well as the following physical responses: moves head away, blocks eye, squeezes eye shut, pushes adult away, or physically resists. The presence or absence of any crying or behavior necessitating physical restraint was recorded at the end of each 1-min interval. The number of minutes needed to insert and remove the lens and the frequency and length of time-out were also recorded. All sessions were videotaped.

After discharge, parents were phoned weekly for 2 months. They were asked to rate seven behaviors during that morning's insertion (five compliance scores, one crying score, and one restraint score) on a 5-point Likert-type scale. At discharge, parents rated the success of and their satisfaction with the procedure on the same type of scale. (Copies of behavioral definitions, the shaping hierarchy, and the interview and evaluation forms may be obtained from the first author.)

Interobserver Reliability

Interobserver agreement, assessed for 25% of the observations over all phases of treatment, was 84.9% (range, 76.9% to 92%) for minute-by-minute occurrence and 98.1% (range, 93.5% to 100%) for minute-by-minute nonoccurrence of the observed behaviors. Only Charles' family conducted reliability checks at home (for 4 of 10 observations). Of the seven items on the 5-point scale, reliability was 67.8% for exact agreement and 100% for agreement (± 1 point).

Design

Because children were seen over an 18-month period as referrals were received, the study used a nonconcurrent multiple baseline design across subjects, with changing criteria (Kazdin, 1982).

Procedure

Baseline. Due to time constraints, after referrals were received and consent was obtained, each child was randomly assigned to a baseline of one, two, or three points. Because of potential aversive conditioning during baseline, actual insertion of the lens was not attempted. Instead, six steps in the shaping hierarchy were randomly ordered and introduced twice during each session. They included touching the child's face, pulling open the eyelid, having the child pull open an eyelid, placing drops in eyes, approaching the child's eye with a finger, and touching the child's eye with a finger.

Initial lens shaping. The initial shaping procedure consisted of systematic introduction of variations of eight steps, including the steps described in baseline as well as touching a soft lens and then a hard lens to the corner of the eye. Child compliance to requests was rewarded with praise, stars, bubbles, food, or access to toys. Noncompliance was followed within approximately 30 s by a warning, followed almost immediately by brief time-out for Pierre, Charles, and Adam, and physical restraint for Joel (whose parents reported this to be effective). Rules for time-out followed a standard protocol (Christophersen, 1988). Because of noncompliance in baseline, Charles was taught general

compliance first. This consisted of rewarding compliance with commands unrelated to contact lenses and using time-out for noncompliance.

Lens insertion. At the start of the week, parents were taught lens care and practiced lens insertion and removal using the therapist's eye. Generally, the therapist first inserted the child's lenses on Wednesday, and parents inserted the child's lenses on Thursday and Friday. Joel had his lens inserted by the ophthalmologist earlier due to miscommunication. Lens use was gradually increased in hourly increments over the week.

Follow-up. Parents were contacted weekly by phone for 2 months. The primary therapist conducted the standardized interview and recorded the parents' responses. At approximately 3-, 6-, and 10-month follow-ups, parents and children returned to the hospital, where the parents were videotaped removing and reinserting the lenses.

RESULTS

Figures 1 and 2 show direct observation and parental report of compliance, crying, and restraint for each child. Overall mean percentage of compliance during baseline was 58.1% (range, 0% to 84.2%), with baselines higher for the 3 children having little or no experience with lens use. Charles showed a mean of 70.2% compliance during the general compliance training, with a drop in compliance occurring when the parents were first introduced into the training phase. During the initial shaping phase, the mean percentage of compliance was 82.1% (range, 69.2% to 100%). Because Joel's lenses were inserted early and seemed to sensitize him to the intervention, the shaping phase was curtailed, and he entered directly into the lens insertion phase. Generally, compliance dropped during lens insertion. Mean percentage of compliance for Pierre, Charles, and Adam was 65.8% (range, 36.7% to 94.4%), with a much lower compliance percentage for Joel, who was restrained ($M = 20.5\%$, range, 0% to 55.5%).

At home following hospital discharge, the parents of Pierre, Charles, and Adam reported a steady improvement in compliance. On a 5-point scale,

the children's mean compliance score was 4.05 (range, 3.2 to 4.7) at 1 week and 4.6 (range, 4.2 to 5) at 6 weeks. At follow-up observations in the hospital, the mean observed compliance was 92.1% (range, 78% to 100%). Time-out consequences for Charles, Adam, and Pierre averaged 1.3 (mean total minutes per time-out = 4.5) during the initial shaping phase and 5.7 (mean total minutes per time-out = 4.9) during the lens insertion phase. No time-out was used during follow-up observations. Adam's and Pierre's parents reported no use of time-out at the weekly time-sampled phone calls, but did state that time-out was used occasionally. Charles' parents reported using time-out five times during the eight sessions sampled during weekly phone calls.

The time needed for lens removal or insertion dropped from a mean of 15 min (range, 3 to 40 min) during intervention to a mean of 2 min (range, 1 to 4 min) for both removal and reinsertion at follow-up. All 3 children continue to use contact lenses daily. Pierre's visual acuity with glasses was 20/40 in the left eye and 20/30 in the right eye. Ten months later, with lenses his visual acuity had improved to 20/25 plus two letters in both eyes. Adam's visual acuity in his left eye improved from 20/70 with glasses to 20/25 with lenses 6 months later. Charles, who has worn lenses since infancy, had a visual acuity with lenses of 20/90 in each eye at 3-month follow-up.

Joel, who was restrained and introduced to the lenses early in the week, showed low compliance throughout treatment. Although the parents reported excellent compliance for the first 3 weeks after discharge, poor fit and an eyelid infection resulted in a drop in compliance. At 16 weeks, because insertion was taking up to 2 hr and poor fit resulted in frequent loss of a lens, the parents chose to discontinue the use of contact lenses.

There was a mean of 18.8 sessions over the week (range, 16 to 24), lasting a mean of 18 min (range, 2 to 66 min). Sessions were followed by frequent breaks of 30 to 60 min. Mean therapy time was 5 hr 59 min (range, 3 hr 18 min to 7 hr 42 min).

At discharge, all 4 parents rated their satisfaction with and the success of the intervention very high,

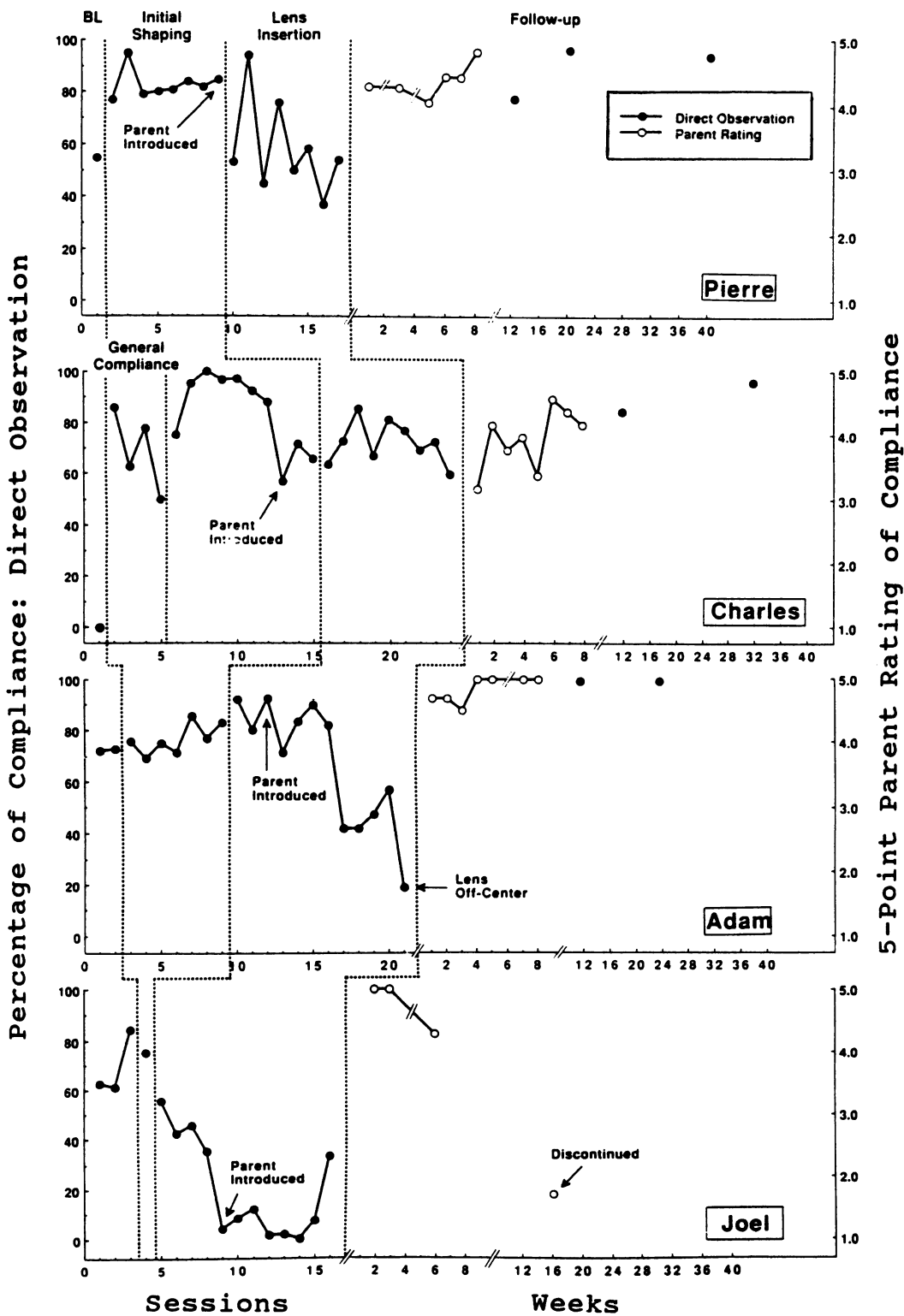


Figure 1. The percentage of directly observed compliance and parent rating of compliance on a 5-point scale.

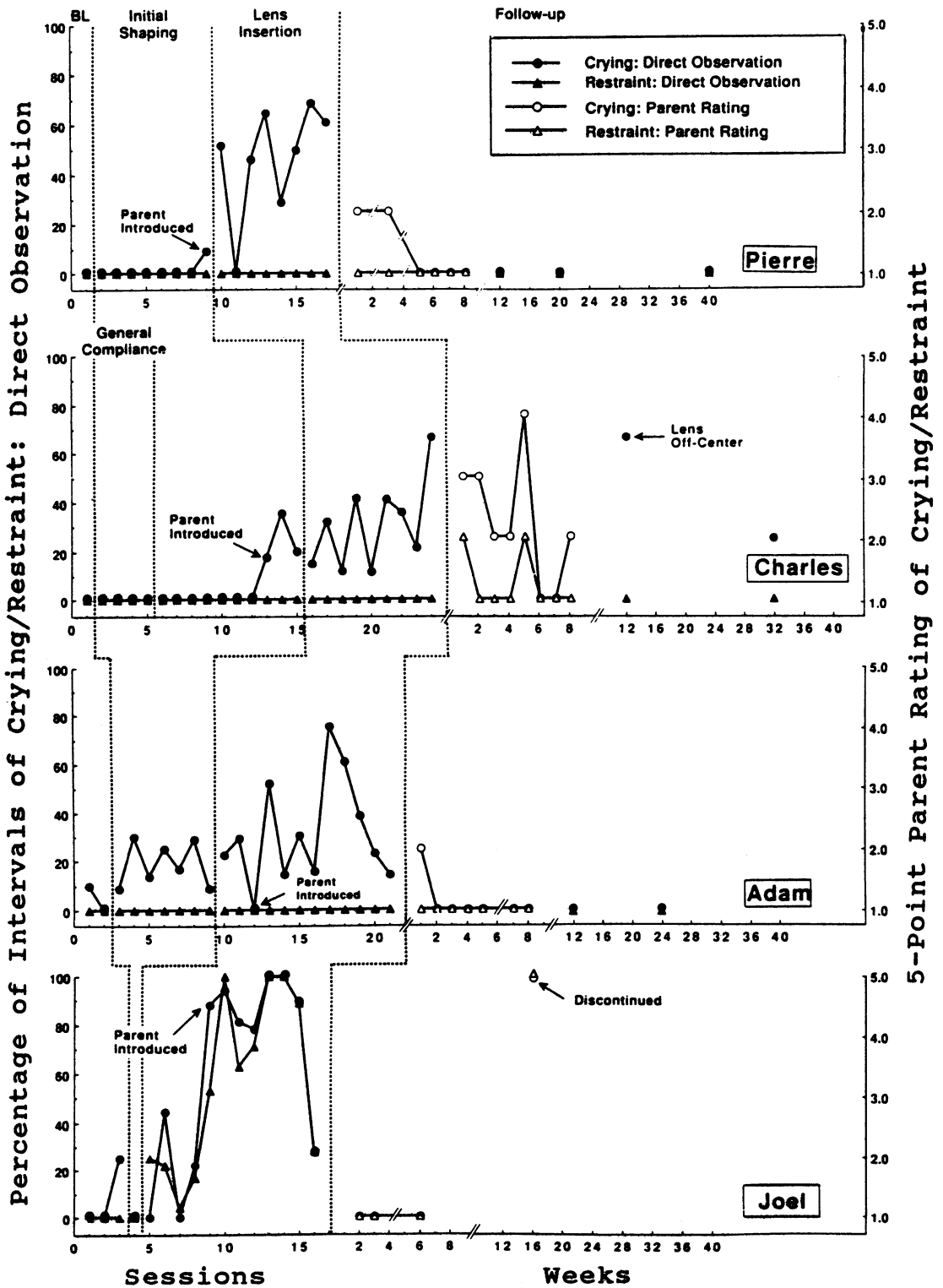


Figure 2. The mean percentage of directly observed 1-min intervals with crying or physical restraint and parent ratings of crying or physical restraint on a 5-point scale.

and reported confidence that their child would continue to use the lenses. However, Adam's and Joel's parents stated that more intervention time was needed.

DISCUSSION

This study analyzed the use of a shaping procedure to teach contact lens use in young children with severe visual limitations. Three of the 4 children demonstrated high levels of compliance at 3- to 10-month follow-ups and continue to use their lenses daily. The 4th child had initial success at home, but poor fit and an eyelid infection resulted in resistance to the lens insertion, and the parents eventually discontinued use of the lenses. This procedure has been used successfully with 11 of 13 other children between the ages of 14 months and 7 years 4 months (LaRoche & Hodson, 1989). The improved visual acuity in 2 of the children confirms the value of contact lens use (Levin *et al.*, 1988).

We applied a shaping procedure for a new and complex behavior. Because contact lens insertion requires precise adult fine-motor skills, child compliance is essential. The child must learn to minimize the blinking reflex when the lids or orbit are touched and to suppress the impulse to rub the eye, which may be irritated with initial insertion. For this reason, a longer period of parental practice with the therapist or with a doll prior to inserting a lens in the child's eye might have minimized crying and noncompliance during the lens insertion phase.

The limited baselines and descending trends in compliance during the lens insertion phase suggest caution in concluding that this intervention was responsible for the ultimate success in lens use found at follow-up. The descending trend was probably due to the combination of the children adjusting to a foreign object in their eyes and the parents learning to insert and remove the lenses. Because of a corneal scar, centering the lens was particularly problematic for Adam, and low compliance was usually related to inaccurate initial placement and the subsequent need for centering. The dramatic improvement in compliance at the 1-week follow-

up suggests that a longer treatment phase may have helped.

It is possible that the children would have adjusted on their own with experience and parents' improved skills in inserting and removing the lenses. However, the poor compliance demonstrated by Charles after almost 2 years of lens use suggests that some children may not adjust to lens insertion and removal even if they enjoy the benefits of improved vision. Furthermore, Joel's discontinuation of lens use suggests that for some parents the benefits of lenses may not outweigh the problems of dealing with noncompliance of lens insertion and removal, particularly if the fit is poor.

Not all children are good candidates for contact lenses. In addition to problems of lens fit, behavioral problems such as hyperactivity or equivocal parental commitment may preclude success in introducing lenses. Further study is necessary to help the ophthalmologist screen appropriate candidates and to identify those children who are at risk for noncompliance and consequently should be referred to a behavioral psychologist.

The total cost of this intervention was approximately \$1,000 to \$1,300 per child, including hospital and therapist fees. This cost could be reduced substantially by seeing children as outpatients and/or by teaching technicians to do most of the training.

In summary, this study documented a unique use of shaping for the complex behavior of contact lens use in young children. This approach has an important role in the rehabilitation (and, potentially, in the overall development) of children with visual impairment.

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